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error of .1 per cent. It should be understood that this density refers to measurements at room temperature. The coefficient of expansion of NaCl is given by the Smithsonian Tables as $.40 \times 10^{-4}$, so that a variation of 10°C. in either direction from normal room temperature would make an error of less than .05 per cent. in the side of the cube.

The volume of the unit cube of NaCl is therefore

$$V = \frac{\text{Mass}}{\text{Density}} = \log^{-1} \bar{23}.34600 \\ = 22.182 \times 10^{-24} \text{ cc.}$$

and the side of the unit cube is

$$d = \log^{-1} \bar{8}.44867 \\ = 2.810 \times 10^{-8} \text{ cm.}$$

Even if all the values entering into this result were in error to the maximum amount, and all in such a direction as to affect the final result in the same sense, the change in the value of d would be less than .1 per cent.

For purposes of reference, the table below gives the logarithms of the interplanar distances of a simple cube of side $\log^{-1} \bar{4}.4867$ and the actual distances to three decimal places. These lines are all found in the powder diffraction pattern of NaCl. The additional lines of the face-centered cube of Cl ions ($d = 5.620$) are not included in the table as they are too faint to measure easily on a film and are therefore useless for calibration purposes.

Plane	Log Distance	Distance
100 .....	.44867	2.810
110 .....	.29816	1.987
111 .....	.21011	1.622
100 (2) .....	.14764	1.405
210 .....	.09919	1.257
211 .....	.05960	1.147
110 (2)	$\bar{1}.99713$	.993
{ 211		
{ 100 (3)	$\bar{1}.97115$	.936
310	1.94867	.889
311	$\bar{1}.92798$	.847
111 (2)	$\bar{1}.90908$	.811
320	$\bar{1}.89170$	.779
321	$\bar{1}.87561$	.751
100 (4)	1.84661	.702
{ 410		
{ 322	$\bar{1}.83345$	.681
{ 411		
{ 110 (3)	$\bar{1}.82104$	.662

331	$\bar{1}.80930$	.645
210 (2)	$\bar{1}.79816$	.628
421	$\bar{1}.78756$	.613
332	$\bar{1}.77746$	.599
211 (2)	$\bar{1}.75857$	.574
{ 430		
{ 100 (5)	$\bar{1}.74970$	.562

WHEELER P. DAVEY

GENERAL ELECTRIC COMPANY,
SCHENECTADY, N. Y.

THE AMERICAN ELECTROCHEMICAL SOCIETY

SOCIAL EVENTS, LECTURES

It was generally conceded by all in attendance at Lake Placid that a most unique meeting place had been selected for a Fall meeting. Through the courtesy of the Lake Placid Club their recreation facilities were placed at the disposal of our members and afforded excellent opportunities for taking part in golf, tennis, motoring and mountain hiking.

A great deal of the success of the meeting is due to Mr. W. M. Corse, who spared no effort as acting chairman of the arrangements committee.

On Thursday, September 29, at 9 A.M., the fortieth General Meeting of the Society was called to order by President Acheson Smith, who then introduced Dr. Melvil Dewey, founder and president of the Lake Placid Club. Dr. Dewey cordially welcomed our members and mentioned several points of interest that everyone should see while at Lake Placid. The reading and active discussion of papers followed this talk and were continued in the mornings of the next two days, the features of which were respectively the symposiums on Non-ferrous Metallurgy and Electrodeposition.

The boat ride, on Thursday afternoon, comprising a round trip on Lake Placid, was enjoyed by each of the 48 persons on board.

A brief history of the Lake Placid Club was outlined by Dr. Dewey in a short talk preceding the lecture on "Chemistry and the Stars" by Professor Harlow Shapley. With the aid of lantern slides Professor Shapley presented a very interesting account of the stellar universe and of the work being done at the Mt. Wilson Observatory.

Friday afternoon. A mountain hike up Mt. McIntyre was a thrilling experience for all in the party. The club lodge at the base of this peak was reached by motor car through 10 miles of winding roads. An unusual rain storm prevailed before the party had reached the halfway mark, but this was

no obstacle in the way of seven or eight who finally succeeded in reaching the summit.

On Friday evening Dr. Dewey gave a number of illustrations on "How English can be made the world language by removing the chief obstacle in learning it." This talk was followed by an illustrated lecture on "The practise of forestry on national forests," by Col. T. S. Woolsey. Col. Woolsey has been connected with U. S. Forest Service and his various slides were very interesting.

Mr. Arthur Delroy very cleverly explained how character is read from hands and handwriting, and gave illustrations of how the "impossible" or magic trick was performed on the stage.

Later in the evening an informal dance closed the social events of the meeting.

TECHNICAL SESSIONS

Each of the three technical sessions was attended by a number of members and guests who took active part in discussing the papers presented. The result was that the proceedings, carried out according to schedule, were lively as well as interesting.

The Thursday morning session was filled by reading and discussion of papers:

Experiences with alkaline and alkaline earth metals in connection with non-ferrous alloys: CHARLES VICKERS. Sodium appears to have a negative value for copper, but seems to be superior to phosphorus in deoxidizing bronze. Calcium, of the alkaline earth metals, appears valueless in producing sound copper castings. As a deoxidizer, calcium is best adaptable when combined with an acid element, as silicon, and is further improved when combined with a third element.

The electrolytically produced calcium-barium-lead alloys comprising Frary metal: W. A. COWAN, L. D. SIMPKINS and G. O. HIERS. This paper presented by Mr. Hiers described the development of Frary Metal and its production by electrodeposition from a mixture of calcium and barium chlorides over a bath of molten lead as cathode. The properties of Frary metal are compared with those of other bearing metals. As a bearing metal it has desirable hardness and strength at elevated temperatures.

The electrolytic corrosion of lead-thallium alloys: COLIN G. FINK and C. H. ELDRIDGE. Presented by DR. FINK. Anodic corrosion losses in an acid copper sulfate electrolyte containing nitric and hydrochloric acids are reduced by using lead-thallium alloys. A minimum loss of 1.2 lb. per 100 lb. of copper deposited resulted with a lead anode containing 10 per cent. Tl and 20 per cent. Sn.

A new theory of the corrosion of iron: J. NEWTON FRIEND. An auto-colloidal catalytic theory, which postulates the corrosion as starting by the formation of colloidal ferrous hydroxide. This by contact with the air forms hydrated ferric hydroxide which in turn is alternately reduced by contact with iron and oxidized by contact with air, thus continuing the corrosion.

Rust prevention by slushing: HAAKON STYRI. An extended research which shows that for protection against rust by greases a thorough cleaning of the steel parts by an aqueous solution is essential; an oil emulsion which leaves an oil film for short time protection is preferable. Such emulsions protect against rust.

Transformer oil sludge: C. J. RODMAN. Of the three types of transformer oil sludge (asphaltic, soap and carbon), the asphaltic is the most general form and is the oxidation product of an attackable oil. It collects upon the active parts of transformer. The soap sludge forms slowly and is difficult to remove by filtration. The carbon sludge is caused by electrical breakdown.

The electrolysis of organic compounds: RAYMOND FREAS. The author endeavors to encourage further research of organic compound electrolysis. The discussion, limited to electro-reduction processes, presents the factors influencing the relative velocities of reaction, and despite their great number it is maintained possible to secure selective reduction electrolytically. A convenient experimental arrangement is described.

Electrolytic oxidation of the leuco-base of malachite green: ALEX. LOWY and E. H. HAUX. That the dye stuff malachite green can be produced by electrolytic oxidation of the leuco-base is set forth in a series of experiments. The highest dye yield resulted with uranyl sulphate as catalyst, platinum cathode, and nichrome gauze anode in dilute sulphuric acid solution, at 85° C.

The electrolytic dissociation of cyanamide and some of its salts in aqueous solution: N. KAMEYAMA. The degree of dissociation and of hydrolysis of sodium and calcium cyanamide was determined; from this the dissociation constant was calculated and the mobility of the cyanamide anion estimated.

Electrolytic production of sodium perborate: P. C. ALSGAARD. After presenting a detailed account of the work by Arndt and by Valeur, the author relates the results of his experiments and their application to larger scale production.

The electrolytic oxidation of hydrochloric acid to perchloric acid: H. M. GOODWIN AND E. C. WALKER. The investigation and data present the effect of acid concentration, current density, duration of electrolysis and temperature on the yield of perchloric acid. A cell yielding 800 grams of 60 per cent. acid per 24 hours is described.

Graphic control of electrolytic processes: B. G. WORTH. A graphic method of maintaining fixed conditions in potassium chlorate production is presented. Of the three factors which influence the yield, two represent concentrations of 2 compounds one of which is controllable by addition agents, and the third is temperature.

Friday morning was devoted to a Symposium on Non-ferrous Metallurgy. The papers included were:

The influence of the electric furnace on the metallurgy of non-ferrous metals: H. M. ST. JOHN. The use of the electric furnace in brass foundries and refining plants for melting purposes has revolutionized metal handling methods; a more uniform quality of product is obtained with less labor and less metal wastage. The attainments are better than have been previously possible and the secretiveness which has been characteristic of the non-ferrous industry is gradually being done away with.

Modern developments in the British brass industry: E. A. SMITH. The actual condition of the British brass industry is presented with a discussion of electric brass furnaces, hot pressing and forging in brass, rolling mill practice, annealing, etc.

Resistance type of electric furnace in the melting of brass and other non-ferrous metals: T. F. BAILY. The various features to be considered in making an electric furnace installation for melting non-ferrous metals are discussed.

Comparison of electric furnace practise with fuel-fired furnace practise: N. K. B. PATCH. The author's experiences are that the cost of metal melted, the melting losses, and the solution of gases in metal, are substantially the same in the electric and the fuel-fired furnace, providing intelligent operation is pursued.

Electric silver melting: H. A. DEFRIES. Describes advantages of electric furnace melting of silver and relates how a more ductile and tougher silver results upon introducing an iron block into the bath.

Electric furnace melting of nickel-silver: F. C. THOMPSON. Advantages of melting nickel-silver in the externally heated electric furnace are discussed.

Aluminum-copper alloys: R. J. ANDERSON. A discussion of the manufacture, properties and uses of the commercial aluminum-copper alloys employed in the United States.

Recent developments in electric furnaces of the muffled arc type: H. A. WINNE. Several types of muffled arc melting furnaces are described with their features and adaptabilities.

Electric furnace purification of zirkite: J. G. THOMPSON. The arc type furnace used in this investigation made it possible to remove 90-95 per cent. Si as an impurity from the zirkite ore; the amount of carbon introduced being only sufficient to transform the silicon to the carbide.

Physical characteristics of specialized refractories. Cross breaking strength at 20° and 1350° C.: M. L. HARTMAN AND W. A. KOEHLER. The tests were carried out on each of ten refractory materials at the temperatures indicated.

An Electrodeposition Symposium was the feature of the morning of the closing day of the meeting, Saturday, October 1. The papers discussed were:

An electric steam-generator for low voltage: F. A. LIDBURY AND F. A. STAMPS. An inexpensive form of apparatus for the generation of steam by means of an alternating current of voltages from 100 to 500.

The effect of pressure on overvoltage: H. M. GOODWIN AND L. A. WILSON. The values of overvoltage of hydrogen against copper, nickel and mercury electrodes were determined at pressures varying from one atmosphere to a few centimeters of mercury.

Researches on the electrodeposition of iron: W. E. HUGHES. The results of several experiments and those obtained by the author are related in the electrodeposition of iron from (1) sulphate solutions, (2) chloride solutions and (3) sulphate-chloride solutions.

Electrolytic solution and deposition of copper: T. R. BRIGGS.

Electrometallurgy of zinc: W. R. INGALLS. The developments in the electrolytic zinc extraction process and the progress, in Scandinavia, of electrothermic smelting are set forth.

Deposition of zinc from the zinc cyanide solution: C. J. WERNLUND. This research was carried out with the intention of obtaining a zinc cyanide plating solution which would operate successfully under the most trying commercial conditions.

The electrodeposition of lead-tin alloys: WM. BLUM AND H. E. HARING. That a finer grained de-

posit of alloys of lead and tin can be obtained from fluoborate solutions than is possible when depositing either of the metals under similar conditions is established.

The structure and properties of alternately electro-deposited metals: WM. BLUM. If during the deposition of copper thin layers of nickel are interposed, a deposit of greater tensile strength than pure copper results due to the restraining influence nickel has on the growth of copper crystals.

In all the meeting proved to be most profitable, social and instructive.

A. D. SPILLMAN,
Secretary

THE OPTICAL SOCIETY OF AMERICA

HELMHOLTZ MEMORIAL MEETING

THE sixth meeting of the Optical Society of America was held in Rochester, N. Y., October 24, 25, 26, 1921. 113 persons were registered in attendance. The attendance at various sessions varied from about 35 to 100 or more.

The most notable feature of the meeting was the Helmholtz Memorial Meeting held on the afternoon and evening of Monday, October 24. The following former students of Helmholtz were present: Professor Henry Crew, Professor C. R. Mann, Professor Ernest Merritt, Professor E. L. Nichols, Professor M. I. Pupin, Dr. Ludwik Silberstein. The afternoon program was as follows:

A brief survey of the historical development of optical science: PROFESSOR J. P. C. SOUTHALL.

Helmholtz's early work in physics—the conservation of energy: PROFESSOR HENRY CREW.

Helmholtz's contributions to physiological optics: L. T. TROLAND.

Professor Crew exhibited lantern slides showing Helmholtz at the time he wrote the essay on the Conservation of Energy (age 26) and also at later periods of his life.

At the evening session Professor M. I. Pupin spoke informally and in most interesting and delightful manner on his Personal Recollections of Helmholtz. Professor E. L. Nichols, Professor Ernest Merritt, Dr. Ludwik Silberstein, Mrs. Christine Ladd-Franklin and Professor C. R. Mann also spoke of their memories of Helmholtz as a teacher.

Professor Mann showed a lantern slide of a photograph which he himself made on July 7, 1894, showing Helmholtz at his lecture desk only a few days before his last illness.

The Helmholtz Memorial addresses will be published in the Journal of the Optical Society of America.

Various scientific societies were represented at the meeting by delegates as follows:

American Mathematical Society: Professor A. S. Gale.

American Physical Society: Professor M. I. Pupin, Dr. L. T. Troland, Professor Henry Crew.

American Association for the Advancement of Science: Professor M. I. Pupin.

New York Academy of Science: Professor M. I. Pupin.

American Academy of Ophthalmology and Otolaryngology: Dr. R. S. Lamb.

American Medical Association, Section of Ophthalmology: Dr. W. B. Lancaster.

American Ophthalmological Society: Dr. Lucien Howe, Dr. George S. Crampton.

Society of Illuminating Engineers: Dr. George S. Crampton.

American Psychological Association: Dr. L. T. Troland, Mr. Prentice Reeves, Professor C. E. Ferree, Dr. P. W. Cobb.

The following papers were presented at the regular sessions of the Society on October 25 and 26.

Photo-electric potentials from the retina: E. L. CHAFFEE AND W. T. BOVIE (to be published in full in the *Jour. Op. Soc. Am.*).

Intensity and composition of light and size of visual angle in relation to important ocular functions: C. E. FERREE AND GERTRUDE RAND.

A theory of intermittent vision: HERBERT E. IVES (to be published in full in the *Phil. Mag.*).

An analysis of the visibility curve in terms of the Weber-Fechner law and the least perceptible brightness: ENOCH KARRER (to be published in full in the *Jour. Op. Soc. Am.*).

A quantitative determination of the inherent saturation of spectral colors: L. T. TROLAND (to be published in full in the *Jour. Op. Soc. Am.*).

The interrelations of brilliance and chroma studied by a flicker technique: L. T. TROLAND AND C. H. LANGFORD (to be published in full in the *Jour. Op. Soc. Am.*).

A proposed standard method of colorimetry: HER-